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In re Patent Application of:

Tatsuhiko OBAYASHI et al.

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For: ANTI-REFLECTION FILM, POLARIZING PLATE AND DISPLAY DEVICE

DECLARATION UNDER 37 C.F.R. § 1.132

Commissioner for Patents
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Sir:

I, Tatsuhiko OBAYASHI, hereby declare and state that:

1. I am a citizen of Japan residing at c/o Fuji Photo Film Co., Ltd., No. 210 Nakanuma, Minami-ashigara-shi, Kanagawa-ken, Japan.

I received a Master's degree from Kyoto University, Faculty of Engineering, Department of Synthetic Chemistry, in March of 1990.

Since April, 1990, I have been employed by Fuji Photo Film Co., Ltd. and have been engaged in research and development on photographic couplers and additives (from 1990 to 1994), dry films for graphic art (from 1995 to 1998), materials for an anti-reflection film (from 1999 to 2003) and films for a next-generation display (from 2004 up to date), at the Ashigara Research Laboratory of the said company.

I am one of the joint inventors of the subject matter of the United States Patent Application Serial No. 10/612,022, filed on July 3, 2003, and am thus

intimately familiar with the contents of the application, its prosecution before the United States Patent & Trademark Office, and the references cited therein.

2. I have studied the contents of the cited Tsukada et al.'s U.S. Patent No. 6,129,980 B1.

3. To show the superiority of the present invention, the following tests were conducted, by me or under my supervision:

Test

(1) Test 1

Anti-reflection film samples X, Y, and Z were prepared in the same manner as Sample 124 in Example 1 of the present specification, except that the coating solution for low the refractive index layer of Sample 124 was replaced by the low-refractive-index-layer compositions F, G, and I according to U.S. 6,129,980, respectively, as shown in Table A.

Anti-reflection film samples 124 to 129 in Example 1 described in the present specification were prepared again. In this connection, the thermally crosslinkable fluorine-containing polymer JN-7228 contained in the coating solutions for the low-refractive-index layers D to G was a perfluoroolefin copolymer, i.e. a copolymer of hexafluoroolefin.

The low-refractive-index-layer compositions F, G, and I for Samples X to Z each contained a fluorine-containing polymer in the form of particle, while the coating solutions for the low-refractive-index layer of Samples 124 to 129 each contained a perfluoroolefin copolymer in the form of uniform solution.

Table A

Sample No.	Coating solution for hard coat layer	Coating solution for anti-glare hard coat layer	Coating solution for low-refractive-index layer
X (Comparative example)	B	A	F of US6,129,980
Y (Comparative example)	B	A	G of US6,129,980
Z (Comparative example)	B	A	I of US6,129,980
124 (This invention)	B	A	D
125 (This invention)	B	A	E
126 (This invention)	B	A	F
127 (This invention)	B	A	G
128 (This invention)	B	A	H
129 (This invention)	B	A	I

These samples were evaluated for (1) average specular reflectance, (2) haze, (3) pencil hardness, (4) contact angle and fingerprint adhesion, (5) dynamic friction coefficient, (6) anti-glare property, (7) glistening, (8) steel wool scratch resistance, (9) wet-swab rubbing resistance, in the same manner as in Example 1 in the present specification. The results are shown in Table B below.

Table B

Sample	Average specular reflectance (%)	Haze (%)	Pencil hardness	Contact angle [°]	Finger-print adhesion	Dynamic friction coefficient	Anti-glare property	Glistening	Steel wool scratch resistance	Wet-swab rubbing resistance	Remarks
X	2.1	14.0	○	42	×	0.38	◎	○	○△	○△	Comparative example
Y	2.0	14.2	○	38	×	0.39	◎	○	○△	○△	Comparative example
Z	2.1	15.7	○	45	×	0.33	◎	○	○△	○△	Comparative example
124	2.0	16.0	△	102	○	0.08	◎	○	○	○△	This invention
125	2.1	15.2	△	103	○	0.08	◎	○	○	○△	This invention
126	1.9	15.6	△	102	○	0.08	◎	○	○△	○△	This invention
127	2.1	16.2	△	101	○	0.08	◎	○	○△	○△	This invention
128	2.0	15.5	○	102	○	0.08	◎	○	○	○	This invention
129	2.1	15.4	○	102	○	0.08	◎	○	○	○	This invention

Gist of evaluation criteria

Pencil hardness (n=5): "○", no scratch marks; "△", 1 or 2 scratch marks; and "×", at least 3 scratch marks.

Fingerprint adhesion: fingerprints left thereon were "○", completely wiped off; "△", some remained; "×", hardly wiped out. Anti-glare property: the outline of the fluorescent lamp was "○", not recognized; "○", slightly recognized; "△", blurred but recognizable; "×", hardly blurred.

Glistening: "○", no glistening; "△", slightly glistening; "×", observable with the naked eye.

Steel wool scratch resistance: "○", no scratches; "○", soft scratches with careful inspection; "○△", visible soft scratches; "△", moderate scratches; "×", hard scratches.

Wet-swab rubbing resistance: separation of the film occurred in "×", 0-10 strokes; "×△", more than 10-30 strokes; "△", more than 30-50 strokes; "○△", more than 50-100 strokes; "○", more than 100-150 strokes, and "○", no separation occurred.

From the results shown in Table B, it can be understood that Samples X to Z were poor in anti-staining properties (represented by contact angle and wiping off of fingerprint left thereon), though they were good in anti-reflection properties (represented by anti-glare property and glistening) and pencil hardness (represented by scratch resistance). In contrast, Samples according to the present invention were excellent in both of anti-reflection properties and anti-staining properties, as well as the other properties.

(2) Test 2

The above Samples X, Y, and Z and Samples 124 to 129 were subjected to the saponification treatment, and evaluated for film separation and cross cut adhesion, in the same manner as in Example 1 in the present specification. The results are shown in Table C below.

Table C

Sample	Film separation	Crosscut adhesion	Remarks
X	×	×	Comparative example
Y	×	×	Comparative example
Z	×	×	Comparative example
124	○	○	This invention
125	○	○	This invention
126	○	○	This invention
127	○	○	This invention
128	○	○	This invention
129	○	○	This invention

From the results shown in Table C, it can be understood that the adhesion properties of Samples X to Z after the saponification treatment were insufficient, while those of Samples 124 to 129 were excellent.

From the above results the following reasons are presumed. In a film of

U.S. 6,129,980, in which fine particles of fluorine-containing polymer are used in a low-refractive-index layer, there would be paths between the particles, through which an alkaline solution can penetrate. When the film is subjected to saponification treatment, the alkaline solution penetrates induces hydrolysis of the silane compound used as a binder, in the low-refractive-index layer. As a result, the film tends to exhibit unsatisfactory adhesive properties, scratch resistance, and film separation. In contrast, the film wherein perfluoroolefin copolymer is used in the form of uniform solution is superior in resistance to saponification, because fluorine atoms of the perfluoroolefin easily segregate to the outer surface of the low-refractive-index layer, and prevent permeation of the alkaline solution.

The data already of record in the specification and the supplemental data submitted herewith demonstrate unexpectedly superior results of the claimed anti-reflection film, method for producing the same, polarizing plate, and image display device over those of the cited prior art.

4. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Date: March 08, 2006

Tatsuhiko Obayashi
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